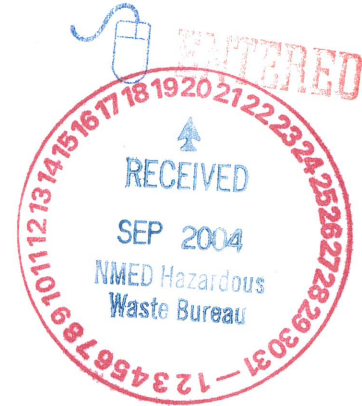


Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221
September 17, 2004



Mr. Steve Zappe, WIPP Project Leader
Hazardous Waste Permits Program
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2905 E. Rodeo Park Drive, Bldg. 1
Santa Fe, NM 87505

Subject: Transmittal of Approved AMWTP WSPF BNINW216, Revision 1, First/Second
Stage Sludge

Dear Mr. Zappe:

The Department of Energy, Carlsbad Field Office (CBFO) has approved the Advanced
Mixed Waste Treatment Project (AMWTP), Waste Stream Profile Form (WSPF)
BNINW216, Revision 1. Enclosed is a copy of the approved form as required by Section B-
4(b)(1) of the WIPP Hazardous Waste Facility Permit No. NM4890139088- TSDF.

If you have any questions on this matter, please contact me at (505) 234-7357 or
(505) 706-0066.

Sincerely,

Kerry W. Watson, Director
Office of Characterization and Transportation

Enclosure

cc: w/o enclosure
J. Bearzi, NMED
J. Kielling, NMED
C. Walker, TechLaw
M. Strum, WTS *ED
R. Chavez, WRES *ED
L. Greene, WRES *ED
K. Zbryk, WRES *ED
W. Ledford, CTAC *ED
WIPP Operating Record
CBFO M&RC

*ED denotes Electronic Distribution





Waste Stream Profile

AMWTP Form 1195
Rev. 1
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WIPP WASTE STREAM PROFILE FORM

Waste Stream Profile Number: BNINW216, Rev. 1
Generator site name: Advanced Mixed Waste Treatment Project Technical contact: Eric Schweinsberg
Generator site EPA ID: ID4890008952 Technical contact phone number: (208) 557-7164
Date of Audit report approval by NMED: 12/23/2003
Title, version number, and date of documents used for WAP certification:
Certification Plan for INEEL CH-TRU Waste, MP-TRUW-8.1, Revision 3, 12/16/03, Revision 4 3/4/04, Revision 5 8/18/04
TRUPACT-II Authorized Methods for Payload Control, MP-TRUW-8.3, Revision 1, 2/6/03, Revision 2 3/29/04
Quality Assurance Project Plan, MP-TRUW-8.2, Revision 2, 3/31/03, Revision 3 8/19/04
Did your facility generate this waste? ☐ Yes ☒ No If no, provide the name and EPA ID of the original generator:
Rocky Flats Environmental Technology Site, CO7890010526

Waste Stream Information¹

IN-W216.875, IN-W216.98,
IN-W216.99, IN-W228.101,
IN-W228.102, IN-W228.103,
WIPP ID: IN-W228.883 Summary Category Group: S3000
S3100 - Inorganic
Waste Matrix Code Group: Homogeneous Solids Waste Stream Name: First/Second Stage Sludge
Description from the WTWBIR: See First/Second Stage Sludge AMWTP Waste Stream Summary, BNFL-5232-RPT-TRUW-09, Rev. 2

Defense TRU
Waste: (Ref. 9) ☒ Yes ☐ No Check One: ☒ CH ☐ RH
Number of SWBs 0⁵ Number of Drums 21,304 Number of Canisters 0
Batch Data report numbers supporting this waste stream characterization: See Characterization Information Summary, Table 5
D004, D005, D006, D007, D008, D009, D010, D011, D022, F001, F002, F003, F005,
F006, F007, and F009
List applicable EPA Hazardous Waste Codes:²
See Reference List, No. 8, Section 1.6
Applicable TRUCON Content Codes: ID111A, ID111C, ID211A, ID211C, ID111D, ID211D

Acceptable Knowledge Information¹

[For the following, enter supporting documentation used (i.e., references and dates)]

Required Program Information

Map of site: Acceptable Knowledge Document for INEEL Stored Transuranic Waste - Rocky Flats Plant Waste, INEL-96/0280, Rev. 3 AMWTP Number P368A, Section 3, Figure 3-1; DWG-5232-52-0101 Site Plan of the Advanced Mixed Waste Treatment Facility

Facility mission description: P368A, Rev. 3, Section 3.1; AMWTP TRU Waste Management Acceptable Knowledge Elements, RPT-TRUW-06, Rev. 1, 11/20/03
Description of operations that generate waste: P368A, Rev. 3, Section 3.1

Waste identification/categorization schemes: Advanced Mixed Waste Treatment Project Waste Stream Designations, BNFL-5232-RPT-TRUW-12, Rev. 1, 11/20/03


Types and quantities of waste generated: P368A, Rev. 3, Section 23; AMWTP TRU Waste Management Acceptable Knowledge Elements, RPT-TRUW-06, Rev. 1; RWMCEDF-837, Estimated Earthen and Geofabric Covered TRU Waste Inventory in the TSA at Radioactive Waste Management Complex (RWMCE), 8/24/95; Container Inventory Report for WMF-629 thru WMF-633, 12/24/02 (U122A)

Correlation of waste streams generated from the same building and process, as appropriate: P368A, Rev. 3

Waste certification procedures: TRU Waste Certification, MP-TRUW-8.5, Rev. 5, 3/28/03; Rev. 6, 4/27/04; Rev. 7, 7/12/04; Rev. 8, 8/4/04; Rev. 9, 8/12/04

Required Waste Stream Information

Area(s) and building(s) from which the waste stream was generated: First/Second Stage Sludge AMWTP Waste Stream Summary, BNFL-5232-RPT-TRUW-09, Rev. 2
Waste stream volume and time period of generation: BNFL-5232-RPT-TRUW-09, Rev. 2

	Waste Stream Profile	AMWTP Form 1195 Rev. 1 Effective Date: 03/28/2003 MP-TRUW-8.14 Page 2 of 3
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Waste generating process description for each building: BNFL-5232-RPT-TRUW-09, Rev. 2

Process flow diagrams: BNFL-5232-RPT-TRUW-09, Rev. 2

Material inputs or other information identifying chemical/radionuclide content and physical waste form: _____

First/Second Stage Sludge AMWTP Waste Stream Summary

Which Defense Activity generated the waste: (check one)

- | | |
|--|--|
| <input checked="" type="checkbox"/> Weapons activities including defense inertial confinement fusion | <input type="checkbox"/> Naval Reactors development |
| <input type="checkbox"/> Verification and control technology | <input type="checkbox"/> Defense research and development |
| <input type="checkbox"/> Defense nuclear waste and material by products management | <input type="checkbox"/> Defense nuclear material production |
| <input type="checkbox"/> Defense nuclear waste and materials security and safeguards and security investigations | |

Supplemental Documentation See P368A, Rev. 3

Process design documents: See P368A, Rev. 3

Standard operating procedures: See P368A, Rev. 3

Safety Analysis Reports: See P368A, Rev. 3

Waste packaging logs: See P368A, Rev. 3

Test plans/research project reports: See P368A, Rev. 3

Site databases: See P368A, Rev. 3

Information from site personnel: See P368A, Rev. 3

Standard industry documents: See P368A, Rev. 3

Previous analytical data: See P368A, Rev. 3

Material safety data sheets: See P368A, Rev. 3

Sampling and analysis data from comparable/surrogate Waste: See P368A, Rev. 3

Laboratory notebooks: See P368A, Rev. 3

Sampling and Analysis Information²

For the following, when applicable, enter procedure title(s), number(s) and date(s)

Radiography: RTR Operations, INST-OI-12, Rev. 10 5/2/03, Rev. 11 5/8/03, Rev. 15 9/25/03, Rev. 16 1/13/04, Rev. 17 2/19/04, Rev. 18 7/15/04, Rev. 18 FC-1 9/4/04

Visual Examination Operating Procedures and Data Reporting, INST-OI-34 Rev. 6, 8/13/03, Rev. 6 FC-1, 8/24/04, Rev. 7, 6/23/04, Rev. 8, 7/15/04, Rev. 9, 8/9/04. *Visual examinations have been conducted on 50 containers from the S3000 summary category group to support establishment of the AMWTP site specific miscertification rate. None of the containers presented in this WSPF have been selected for visual examination by AMWTP. All containers of S3000 processed through RTR will be eligible for selection in the ongoing visual examination program.*

Visual Examination: the ongoing visual examination program.

Headspace Gas Analysis

VOCs: Drum Vent/Headspace Gas Sample Operations, INST-OI-13, Rev. 16, 11/5/03, Rev. 16 FC-1, 11/17/03, Rev. 17 12/11/03, Rev. 18, 2/4/04, Rev. 19, 7/12/04

Flammable: Drum Vent/Headspace Gas Sample Operations, INST-OI-13, Rev. 16, 11/5/03, Rev. 16 FC-1, 11/17/03, Rev. 17 12/11/03, Rev. 18, 2/4/04, Rev. 19, 7/12/04

Other gases (specify): N/A

Homogeneous Solids/Soils/Gravel Sample Analysis³

Total metals: ACMM-8909, Microwave Assisted Digestion of Homogeneous Solids, Rev. 3, 7/11/00, ACMM-2900, Determination of Trace Elements by ICP Atomic Emission Spectrometry, Rev. 4⁴, 8/7/00, ACMM-7802, Determination of Mercury by Cold-Vapor Fluorescence Spectrophotometry, Rev. 8 4/5/00.

PCBs: N/A

VOCs: ACMM-9260, VOCs by Gas Chromatography/Mass Spectrometry, Rev. 3, 8/11/00

Nonhalogenated VOCs: ACMM-9441, Determination of Nonhalogenated Volatile Organics by Gas Chromatography, Rev. 4, 8/10/00

Semi-VOCs: ACMM-9270, SVOCs by Gas Chromatography/Mass Spectrometry, Rev. 1, 8/17/00 ACMM-9500, Sample Preparation for SVOCs and PCBs, Rev. 2, 8/1/00

Other (specify): MP-TRUW-8.25, RCRA Statistical Sampling, Rev. 6 5/01/03, Rev. 7, 8/19/04



Waste Stream Profile

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Waste Stream Profile Form Certification:

I hereby certify that I have reviewed the information in this Waste Stream Profile Form, and it is complete and accurate to the best of my knowledge. I understand that this information will be made available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Eric P. Schweinsberg
Signature of Site Project Manager

Eric P. Schweinsberg, SPM
Printed Name and Title

9/17/04
Date

NOTE: (1) Use back of sheet or continuation sheets, if required.

- (2) If radiography, visual examination, headspace gas analysis, and/or homogeneous solids/soils/gravel sample analysis were used to determine EPA Hazardous Waste Codes, attach signed Characterization Information Summary documenting this determination.
- (3) Homogeneous Solids sample analysis data collected and analyzed under a certified program authorized by memorandum CBFO:NTP:KWW:VW:01-1022:UFC:5822 from Dr. Ines R. Triay to Ms. Beverly Cook, titled INEEL Certification Authority for Transportation and Characterization of Homogeneous Solid (S3000) Waste, dated May 18, 2001. This applies only to the data set presented in this WSPF. Future data sets will be sampled and analyzed under current certification programs.
- (4) ACMM-2900 is no longer a certified procedure used by the INEEL. This procedure was used at the time that the solids data was analyzed. Any future analysis conducted in support of ongoing lot characterization will utilize ACMM-2901.
- (5) Standard Waste Boxes (SWBs) are not part of the current AMWTP inventory. However, it is possible that drums will be loaded into SWBs for shipment, therefore the SWB TRUCONs (ID111C and ID211C) have been included as available TRUCONs.

Waste Stream Profile Continuation Sheet

Reference List:

1. *Acceptable Knowledge Document for INEEL Stored Transuranic Waste – Rocky Flats Plant Waste*, INEL-96/0280, Rev. 3, February 28, 2003. AMWTP Number P368A
2. Site Plan of the Advanced Mixed Waste Treatment Facility, DWG-5232-52-0101, Rev. 0, April 29, 1999.
3. AMWTP TRU Waste Management Acceptable Knowledge Elements, BNFL-5232-RPT-TRUW-06, Rev. 1, November 20, 2003.
4. AMWTP Waste Stream Designations, BNFL-5232-RPT-TRUW-12, Rev. 1, November 20, 2003.
5. Estimated Earthen and Geofabric Covered TRU Waste Inventory in the TSA at Radioactive Waste Management Complex (RWMC), RWMC EDF-837, August 24, 1995
6. Container Inventory Report for WMF-629 thru WMF-633 (TRIPS query), December 24, 2002.
7. Advanced Mixed Waste Treatment Facility TRU Waste Certification, MP-TRUW-8.5, Rev. 5, March 28, 2003, Rev. 6 April 27, 2004, Rev. 7, July, 12 2004, Rev. 8 August 4, 2004, Rev. 9 August 12, 2004.
8. Acceptable Knowledge Summary For First/Second Stage Sludge, BNFL-5232-RPT-TRUW-09, Rev. 0, January 2003, Rev. 1, August 19, 2004, Rev. 2, September 16, 2004.
9. Identification of Defense Waste Streams Generated at Rocky Flats Environmental Technology Site (RFETS), U. S. Department of Energy memorandum from G. E. Dials to Jessie M. Roberson and John M. Wilcynski, May 20, 1997.
10. Real Time Radiography Operations, INST-OI-12, Rev. 10, May 2, 2003; Rev. 11, May 8, 2003, and Rev. 15, September 25, 2003, Rev. 16, January 13, 2004, Rev. 17, February 19, 2004, Rev. 18, July 15, 2004, Rev. 18 FC-1, September 4, 2004.
11. Visual Examination Operating Procedures and Data Reporting, INST-OI-34, Rev. 6, August 13, 2003, Rev. 6 FC-1, August 24, 2004, Rev. 7, June 23, 2004, Rev. 8, July 15, 2004, Rev. 9, August 9, 2004.
12. Drum Vent/Headspace Gas Sample Operations, INST-OI-13, Rev. 16, November 5, 2003, Rev. 16 FC-1, November 17, 2003, Rev. 17, December 11, 2003, Rev. 18, February 4, 2004, Rev. 19, July 12, 2004.
13. Microwave Assisted Digestion of Homogeneous Solids, INEEL Analytical Laboratories Department Analytical Chemistry Methods Manual, ACMM-8909, Rev. 3, 7/11/00
14. Determination of Trace Elements by ICP Atomic Emission Spectrometry, INEEL Analytical Laboratories Department Analytical Chemistry Methods Manual, ACMM-2900, Rev. 4, 8/7/00.
15. Determination of Mercury by Cold-Vapor Fluorescence Spectrophotometry, INEEL Analytical Laboratories Department Analytical Chemistry Methods Manual, ACMM-7802, Rev. 8, 4/5/00
16. VOCs by Gas Chromatography/Mas Spectrometry, INEEL Analytical Laboratories Department Analytical Chemistry Methods Manual, ACMM-9260, Rev. 3, 8/11/00

Waste Stream Profile Continuation Sheet

17. Determination of Nonhalogenated Volatile Organics by Gas Chromatography, INEEL Analytical Laboratories Department Analytical Chemistry Methods Manual, ACMM-9441, Rev. 4., 8/10/00
18. SVOCs by Gas Chromatography/Mass Spectrometry, INEEL Analytical Laboratories Department Analytical Chemistry Methods Manual, ACMM-9270, Rev. 1, 8/17/00
19. Sample Preparation for SVOCs and PCBs, INEEL Analytical Laboratories Department Analytical Chemistry Methods Manual, ACMM-9500, Rev. 1, 8/1/00
20. RCRA Statistical Sampling, MP-TRUW-8.25, Rev. 6, May 1, 2003, Rev. 7, August 19, 2004.
21. INEEL Certification Authority for Transportation and Characterization of Homogeneous Solid (S3000) Waste, U. S. Department of Energy Carlsbad Area Office memorandum from Dr. Ines R. Triay to Ms. Beverly Cook, CBFO:NTP:KWW:VW:01-1022:UFC:5822, May 18, 2001.
22. *Waste Isolation Pilot Plant Hazardous Waste Facility Permit*, New Mexico Environment Department, NM4890139088-TSDF, Current to January 15, 2004.
23. *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, U. S. Department of Energy, Carlsbad Field Office, Waste Isolation Pilot Plant, DOE/WIPP 02-3122, Rev. 0.1, July 25, 2002.
24. Waste Stream Profile Form INW216.001-First/Second Stage Sludge, BBWI, May 24, 2001.
25. *Hazardous Waste Code Determination for First/Second Stage Sludge Waste Stream (IDCs 001, 002, 800)*, INEEL/EXT-01-00015, Rev. 2, May 2001.
26. *NMED Approval of the Advanced Mixed Waste Treatment Project Final Audit Report, Audit A-03-05 Waste Isolation Pilot Plant EPA I.D. Number NM4890189088*, Letter from Sandra Y. Martin to Dr Ines Triay, Manager Carlsbad Field Office and Dr. Steven Warren, President Washington TRU Solutions LLC, Dated December 23, 2003.

Characterization Information SummaryLot Number: BNINW216

SQAQ

Kevin Deegan

Date:

9/17/04

SQAQ signature indicates that the information presented in this package is consistent with analytical batch reports.

SPM

Don P. Schmechel

Date:

Sept 17, 2004

SPM signature indicates concurrence with all information presented in this report.

Characterization Information Summary

Characterization Description:

The AMWTP has compiled AK information for the First/Second Stage Sludge waste stream as required by the WIPP WAP and WIPP WAC. In addition, the AMWTP has conducted confirmatory testing using real time radiography, visual examination for establishment of site specific miscertification rate, headspace gas sampling and analysis, and radioassay. To fulfill the solid sampling confirmation data requirement for this profile, the AMWTP used WAP compliant solid sampling data collected in support of INEEL's WSPF INW216.001 as preliminary samples and as the required ("n") samples to determine the mean concentrations and the upper confidence levels (UCL₉₅) for toxicity characteristic compounds and to assign and/or confirm hazardous waste codes.

The statistical assessment of the preliminary sample data presented in the INEEL 3,100 m³ Project report, *Hazardous Waste Code Determination for First/Second Stage Sludge Waste Stream* (IDCs 001, 002, 800), INEEL/EXT-01-00015, Rev. 2 dated May 2001, indicated that at least five (5) drums required coring and sample analysis in accordance with the WAP. Seven drums, two more than required, were randomly selected, cored and analyzed from the entire available population to characterize this waste stream. Analytical data from the seven containers, summarized in Tables 2 through 4 of this profile, satisfy the "n" required sample data for the characterization for all drums that were available for sampling as part of the INEEL 3,100 m³. The following requirements and rationale justify this conclusion.

Section B2-2a in the WAP states:

The preliminary estimates will be made by obtaining a preliminary number of samples from the waste stream or from previous sampling from the waste stream. Preliminary estimates will be based on samples from a minimum of 5 waste containers. Samples collected to establish preliminary estimates that are selected, sampled, and analyzed (in accordance with applicable provisions of the WAP) may be used as part of the required number of samples to be collected. The applicability of the preliminary estimates to the waste stream to be sampled shall be justified and documented.

Justification and documentation of the preliminary estimates involve compliance with the following bullets from the WAP, Section B2-2a:

- *There is documented evidence that the waste containers for the preliminary estimate samples were selected in the same random manner as is chosen for the required samples.*

The seven samples used to characterize the waste were randomly selected. The random selection process is documented in INEEL/EXT-01-00015.

- *There is documented evidence that the method of sample collection in the preliminary estimate samples were identical to the methodology to be employed for the required samples.*

Characterization Information Summary

The seven drums randomly selected from the First/Second Stage Sludge waste stream were core sampled in accordance with the WAP under a sampling program certified May 18, 2001. The seven-drum data set was accepted as characterization data for INEEL's WSPF, INW216.001.

- *There is documented evidence that the method of sample analysis in the preliminary estimate samples were identical to the analytical methodology employed for the required samples.*

The seven randomly selected drums were analyzed under INEEL's WAP compliant program. The data were accepted as characterization data for INEEL's WSPF, INW216.001. At the time of characterization, trans-1, 2-dichloroethylene was not listed in the WAP as a target analyte for headspace gas or solid samples. It was added as a target analyte for both types of analyses in January 2001. Sufficient data is available to determine that trans-1, 2-dichloroethylene is not present in this waste stream. This compound is not identified in AK documentation as a constituent of Rocky Flats Plant waste and has not been detected in 25% or more of the samples collected from any RF waste including the First/Second Stage Sludge waste. The AMWTP has conducted solids sampling and analysis of First/Second Stage Sludge wastes to demonstrate the solids sampling process. Random selection was not conducted at the time, because the only population available for sampling was a very limited group of containers that had already been processed through real time radiography and radioassay. Trans-1, 2-dichloroethylene was included as a target analyte in this solids sampling analytical data for a sample collected in July 2003 and was not detected. The sampling conducted on the small population of First/Second Stage Sludge waste was for the purposes of demonstrating AMWTP's ability to collect solid samples and not for the purposes of characterizing the entire waste stream. Furthermore, the samples collected were not used to satisfy the requirements of the WAP for preliminary data estimates, only for the purpose of demonstration.

- *There is documented evidence that the validation of the sample analyses in the preliminary estimate samples were comparable to the validation employed for the required samples. In addition, the validated samples results shall indicate that all sample results were valid according to the analytical methodology.*

The analytical results were obtained in accordance with WAP required analytical methods and were valid. Validation of the analytical data was performed in compliance with the WAP.

The above discussion demonstrates that the sample set meets the bulleted conditions identified in the WAP for use as preliminary data and the required number of samples. The seven-drum data set is being used as preliminary data for this waste stream. The validation of the sample analyses was performed under the INEEL's WAP compliant program as required for the required "n" samples.


Characterization Information Summary

Reconciliation with Data Quality Objectives

I certify by signature (below) that sufficient data have been collected to determine the following Program-required waste parameters:

WSPF# BNINW216

Data Quality Objective	Yes	No	N/A	Comment
1. Have all containers in the lot been assigned an appropriate Waste Matrix Code?	✓			
2. Have waste material parameter weights been established for each container in the lot?	✓			
3. Does each waste container of waste contain TRU radioactive waste?	✓			
4. Have mean concentrations, UCL ₉₀ values for the mean concentration, standard deviations, and the number of samples collected for each VOC in the headspace gas of waste containers in the waste stream lot been evaluated against the constituent hazardous waste number assignments?	✓			
5. Has the potential flammability of TRU waste headspace gases been evaluated for the lot?	✓			
6. Have mean concentrations, UCL ₉₀ for the mean concentrations, standard deviations, and number of samples collected for VOCs, SVOCs, and metals in the waste stream (if applicable) lot been evaluated against the constituent hazardous waste number assignments?	✓			
7. Does the waste stream exhibit a toxicity characteristic (TC) under 40 CFR Part 261, Subpart C?	✓			
8. Can the waste stream be classified as hazardous or nonhazardous at the 90-percent confidence level?	✓			
9. Have a sufficient number of waste containers been visually examined (as a QC check on radiography) to determine with a reasonable level of certainty that the UCL ₉₀ for the misclassification rate is less than 14 percent for the summary category group?	✓			
10. Was an appropriate packaging configuration and Drum Age Criteria (DAC) applied and documented in the headspace gas sampling documentation and was the drum age criteria met prior to sampling?	✓			
11. Have all TICs been appropriately identified and reported in accordance with the requirements of Section B3-1 for the lot?	✓			
12. Have the overall completeness, comparability, and representativeness QAOs been met for each of the analytical and testing procedures as specified in Sections B3-2 through B3-9 for the lot?	✓			
13. Have the PRQLs for all analyses been met for the lot?	✓			


Signature of Site Project Manager

Eric P. Schweinsberg
Printed Name

9/17/04
Date

Characterization Information Summary

Table 1A. Headspace gas summary data.

ANALYTE	Number of Samples	Number of Samples above MDL ^a	Transformation	Maximum (ppmv)	Mean (ppmv)	Standard Deviation (ppmv)	Upper 90% confidence limit (ppmv)	PRQL (ppmv)	EPA Code
1,1-Dichloroethane ^c	15	1	natural log	2.03	0.437	0.446	0.592	2.30	N/A
1,1-Dichloroethylene ^c	15	2	square root	2.37	1.46	0.470	1.63	3.16	N/A
1,1,1-Trichloroethane ^c	15	10	square root	7.17	3.85	2.34	4.66	3.16	F001/F002 ^d
1,1,2-Trichloro-1,2,2-Trifluoroethane	15	0	none	1.40	1.26	0.177	^b	10	F002 ^d
1,1,2,2-Tetrachloroethane	15	0	none	4.80	4.18	0.786	^b	10	N/A
1,2-Dichloroethane	15	0	none	1.75	1.57	0.152	^b	10	N/A
Acetone ^c	15	3	natural log	3.07	2.33	0.502	2.50	4.61	F003 ^d
Benzene ^c	15	2	natural log	2.15	0.21	0.606	0.422	2.30	F005 ^d
Bromoform	15	0	none	1.35	1.11	0.199	^b	10	N/A
Butanol	15	0	none	11.6	9.81	1.47	^b	100	N/A
Chlorobenzene	15	0	none	3.85	3.33	0.659	^b	10	F002 ^d
Carbon tetrachloride ^c	15	1	natural log	1.69	0.919	0.247	1.01	2.30	F001 ^d
Chloroform	15	0	none	2.10	1.92	0.228	^b	10	D022 ^d
cis-1,2-Dichloroethylene	15	0	none	2.60	2.10	0.634	^b	10	N/A
Ethyl benzene ^c	15	1	square root	3.18	1.96	0.562	2.15	3.16	N/A
Ethyl ether	15	0	none	3.25	2.31	1.19	^b	10	N/A
m&p-Xylene ^c	15	1	natural log	3.32	1.36	0.630	1.58	4.61	F003 ^d
Methanol ^c	15	1	natural log	3.53	2.45	0.324	2.57	4.61	F003 ^d
Methyl ethyl ketone	15	0	none	8.20	6.24	2.49	^b	100	N/A
Methyl isobutyl ketone	15	0	none	11.6	10.1	1.27	^b	10	N/A
Methylene chloride ^c	15	1	natural log	2.54	0.845	0.472	1.01	2.30	F001/F002 ^d
o-Xylene	15	0	none	4.15	4.03	0.152	^b	10	F003 ^d
Tetrachloroethylene	15	0	none	4.85	3.75	1.40	^b	10	F001/F002 ^d
Toluene	15	0	none	3.55	2.93	0.786	^b	10	F005 ^d
trans-1,2-Dichloroethylene	15	0	none	2.70	2.46	0.203	^b	10	N/A
Trichloroethylene ^c	15	4	natural log	2.67	0.881	0.836	1.17	2.30	F001/F002 ^d

Did the data verify the Acceptable Knowledge

Yes ☒

No

- When a measurement is reported as below detection, one-half the analysis method detection limit (MDL) is used. Note that the MDL for a given analyte may vary from sample to sample.
- The means and standard deviation presented are the mean and standard deviation of the method detection limits (after dividing by 2). All measurements are below detection, therefore the upper 90% confidence limit is not calculated.
- All values are presented as transformed values.
- The HWNs for these constituents have been applied based on acceptable knowledge. No additional codes were added as a result of headspace gas sampling.

Statistics Performed by

Signature

Date:

9/17/04

Jeff Eihersm

Characterization Information Summary

Table 1B. Headspace gas summary data – tentatively identified compounds.

Tentatively Identified Compound	Maximum Observed Estimated Concentrations (ppmv)	# Samples Containing TIC	% Detected
None detected during analysis	N/A	N/A	N/A
Did the Data verify the Acceptable Knowledge Yes <u> ✓ </u> No <u> N/A </u>			
If no, describe the basis for assigning the EPA Hazardous Waste Codes: N/A			

Characterization Information Summary

Table 2. Metals summary data.^a

WSPF# BNINW216

ANALYTE	# Samples ^b	# Samples above MDL	Transformation	Maximum (mg/kg)	Mean (mg/kg)	SD (mg/kg)	UCL ₉₀ (mg/kg)	RTL (mg/kg)	EPA Code (D004-11)
Arsenic ^d	7	7	natural log	1.19	0.464	0.498	0.735	4.61	D004 ^c
Barium ^d	7	7	natural log	4.58	3.72	0.463	3.97	7.60	D005 ^c
Cadmium ^d	7	7	natural log	5.35	2.15	1.91	3.19	3.00	D006
Chromium	7	7	none	290	171	101	225	100	D007
Lead ^d	7	7	natural log	7.82	4.97	2.07	6.10	4.61	D008
Mercury ^d	7	7	natural log	0.742	-1.32	1.47	-0.522	1.39	D009 ^c
Selenium	7	7	none	0.490	0.287	0.160	0.374	20	D010 ^c
Silver	7	7	none	200	103	72.5	142	100	D011
Antimony ^d	7	7	natural log	4.79	2.10	1.81	3.09	N/A	N/A
Beryllium ^d	7	7	natural log	7.86	5.87	1.66	6.77	N/A	N/A
Nickel	7	7	none	310	177	90.2	226	N/A	N/A
Thallium ^d	7	5	natural log	1.55	0.002	1.30	0.708	N/A	N/A
Vanadium ^d	7	7	natural log	3.05	2.57	0.323	2.75	N/A	N/A
Zinc ^d	7	7	natural log	7.31	5.25	1.45	6.04	N/A	N/A

Did the data verify the Acceptable Knowledge?

Yes ☒ No ☐

If no, describe the basis for assigning the EPA Hazardous Waste Codes.

- a. Homogeneous Solids sample analysis data collected and analyzed under a certified program authorized by memorandum CBFO:NTP:KWW:VW:01-1022:UFC:5822 from Dr. Ines R. Triay to Ms. Beverly Cook, titled INEEL Certification Authority for Transportation and Characterization of Homogeneous Solid (S3000) Waste, dated May 18, 2001. The data used in support of WSPF INW216.001 is being presented in this WSPF.
- b. The seven solid samples were collected under a WAP certified program during the 3,100 m³ Project to satisfy "n", the calculated number of required waste containers to be sampled, were used as preliminary and as the required samples for this WSPF. The data were originally presented in INEEL/EXT-01-00015 in support of WSPF INW216.001 and are included in this WSPF in tables 2, 3, 3A, 4, and 4A.
- c. These HWNs were assigned to the waste stream based upon acceptable knowledge and have been retained for this waste stream even though the data did not confirm the presence above the regulatory threshold limit.
- d. The maximum, mean, SD, UCL₉₀, and RTL are presented as transformed values.

Statistics Performed by:

Chris Schminke
Signature

Date:

9/17/04

Characterization Information Summary

Table 3A. Total VOC summary data.^{e, h}

ANALYTE	# Samples ^f	# Samples above MDL	Maximum (mg/kg)	Mean (mg/kg)	SD (mg/kg)	UCL ₉₀ (mg/kg)	Limit RTL (mg/kg)	Limit PRQL (mg/kg)	EPA Code
1,1-Dichloroethylene	7	0	0.12	0.109	0.008	^b	14	N/A	N/A
(trans)-1,2-Dichloroethylene ^d	0	N/A	N/A	N/A	N/A	N/A	N/A	10	N/A
1,1,1-Trichloroethane	7	3	3.00	0.804	1.09	1.99	N/A	10	F001/F002 ^g
1,1,2,2-Tetrachloroethane	7	0	0.095	0.109	0.008	^b	N/A	10	N/A
1,1,2-Trichloro-1,2,2-Trifluoroethane	7	0	0.12	0.109	0.008	^b	N/A	10	F002 ^g
1,1,2-Trichloroethane	7	0	0.12	0.109	0.008	^b	N/A	10	N/A
1,2-Dichloroethane	7	0	0.12	0.109	0.008	^b	10	N/A	N/A
Acetone	7	0	0.90	0.735	0.156	^b	N/A	100	F003 ^g
Benzene	7	0	0.12	0.109	0.008	^b	10	10	F005 ^g
Bromoform	7	0	0.12	0.109	0.008	^b	N/A	10	N/A
Butanol	7	0	6.5	5.36	1.13	^b	N/A	100	N/A
Carbon disulfide	7	0	0.12	0.109	0.008	^b	N/A	10	N/A
Carbon Tetrachloride	7	1	4.8	0.779	1.77	^b	10	10	F001/F002 ^g
Chlorobenzene	7	0	0.12	0.109	0.008	^b	2000	10	F002 ^g
Chloroform	7	0	0.12	0.109	0.008	^b	120	N/A	N/A
Ethyl benzene	7	0	0.12	0.109	0.008	^b	N/A	10	N/A
Ethyl ether	7	0	1.05	0.879	0.182	^b	N/A	100	N/A
Isobutanol	7	0	3.00	2.46	0.534	^b	N/A	100	N/A
Methanol	7	3	7.8	3.54	3.11	6.93	N/A	100	F003 ^g
Methyl ethyl ketone	7	0	2.15	1.79	0.381	^b	4000	100	N/A
Methylene chloride	7	1	0.28	0.134	0.065	^b	N/A	10	F001/F002 ^g
m-Xylene	7	1	0.50	0.259	0.107	^b	N/A	10	F003
o-Xylene	7	1	0.50	0.259	0.107	^b	N/A	10	F003
p-Xylene	7	0	0.12	0.109	0.008	^b	N/A	10	F003
Tetrachloroethylene	7	1	0.8	0.21	0.260	^a	14	10	F001/F002 ^g
Toluene	7	1	0.26	0.131	0.058	^b	N/A	10	F005 ^g
Trichloroethylene	7	1	0.36	0.147	0.094	^b	10	10	F001/F002 ^g
Trichlorotrifluoromethane	7	1	0.36	0.147	0.094	^b	N/A	10	N/A
Vinyl chloride	7	0	0.12	0.109	0.008	^b	4	N/A	N/A

Did the data verify the Acceptable Knowledge?

Yes ☒

No ☐

If no, describe the basis for assigning the EPA Hazardous Waste Codes.

- When a measurement is reported as below detection, one-half the analysis method detection limit (MDL) is used. Note that the MDL for a given analyte may vary from sample to sample.
- The mean and standard deviation presented are the mean and standard deviation of the method detection limits (after dividing by 2) since all measurements or all but one measurement are below detection. Therefore, there are no degrees of freedom associated with the t statistic and the upper 90% confidence limit cannot be calculated.
- For toxicity characteristic wastes, the TC limit expressed as the Regulatory Threshold Limit (RTL) is used. For listed wastes, the Program Required Quantitation Limit (PRQL) is used.
- (trans)-1,2-Dichloroethylene was not a target compound at the time the solids data was collected for INW216.001. It was not detected as a TIC in the solid waste stream, and is not above the UCL₉₀ of the PRQL in headspace gas and is not indicated as a potential compound by AK. Therefore, sufficient data has been collected to determine that (trans)-1,2-Dichloroethylene is not present in this waste stream.
- Homogeneous solids sample analyses data collected and analyzed under a certified program authorized by memorandum CBFO:NTP:KWW:VW:01-1022:UFC:5822 from Dr. Ines R. Triay to Ms. Beverly Cook, titled INEEL Certification Authority for Transportation and Characterization of Homogeneous Solid (S3000) Waste, dated May 18, 2001. The data used in support of WSPF INW216.001 is being presented in this WSPF.
- The seven solid samples were collected under a WAP certified program during the 3,100 m³ Project to satisfy "n", the calculated number of required waste containers to be sampled, were used as preliminary and as the required samples for this WSPF. The data were originally presented in INEEL/EXT-01-00015 in support of WSPF INW216.001 and are included in this WSPF in tables 2, 3, 3A, 4, and 4A.
- These HWNs were assigned to the waste stream based upon acceptable knowledge and have been retained for this waste stream even though the data did not confirm the presence above the regulatory threshold limit.
- No transformations were performed on this data-set because there were not a sufficient number of detects in any of the sample sets.

Statistics Performed by:

Signature

Date:

9/17/04

Characterization Information Summary

Table 3B. Total VOC summary data – tentatively identified compounds.^a

Tentatively Identified Compound	Maximum Observed Estimated Concentrations (ppmv)	# Samples Containing TIC	% Detected
None	N/A	N/A	N/A
Did the Data verify the Acceptable Knowledge Yes <u> ✓ </u> No <u> </u> N/A <u> </u>			
If no, describe the basis for assigning the EPA Hazardous Waste Codes: N/A			

- a. Homogeneous Solids sample analysis data collected and analyzed under a certified program authorized by memorandum CBFO:NTP:KWW:VW:01-1022:UFC:5822 from Dr. Ines R. Triay to Ms. Beverly Cook, titled INEEL Certification Authority for Transportation and Characterization of Homogeneous Solid (S3000) Waste, dated May 18, 2001. The data used in support of WSPF INW216.001 is being presented in this WSPF.

Characterization Information Summary

Table 4A. Total SVOC summary data.^{a, d}

Analyte	# Samples ^c	# Samples Above MDL	Maximum (mg/kg)	Mean (mg/kg)	SD (mg/kg)	UCL ₉₀ (mg/kg)	Limit RTL (mg/kg)	Limit PRQL (mg/kg)	EPA Code
1,2-Dichlorobenzene (ortho- Dichlorobenzene)	7	0	0.115	0.115	0	^b	N/A	40	N/A
1,4-Dichlorobenzene	7	0	0.12	0.12	0	^b	150	N/A	N/A
2,4-Dinitrophenol	7	0	0.010	0.010	0	^b	N/A	40	N/A
2,4-Dinitrotoluene	7	0	0.075	0	0.08	^b	2.6	N/A	N/A
Cresols(o, m, p)	7	0	0.115	0.115	0	^b	4000	40	N/A
Hexachlorobenzene	7	1	0.78	0.206	0.253	^b	2.6	N/A	N/A
Hexachloroethane	7	0	0.12	0.12	0	^b	60	N/A	N/A
Nitrobenzene	7	0	0.12	0.12	0	^b	40	40	N/A
Pentaclorophenol	7	0	0.05	0.05	0	^b	2000	N/A	N/A
Pyridine	7	0	1.5	1.26	0.271	^b	100	40	NA
Did the data verify the Acceptable Knowledge? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>									
If no, describe the basis for assigning the EPA Hazardous Waste Codes. N/A									

Notes:

N/A = not applicable. PCBs, listed in this table as Aroclors are not expected constituents of this waste stream based on AK.

- a. Sum of the Aroclors is to be less than 50 ppm
- b. Homogeneous Solids sample analysis data collected and analyzed under a certified program authorized by memorandum CBFO:NTP:KWW:VW:01-1022:UFC:5822 from Dr. Ines R. Triay to Ms. Beverly Cook, titled INEEL Certification Authority for Transportation and Characterization of Homogeneous Solid (\$3000) Waste, dated May 18, 2001. The data used in support of WSPF INW216.001 is being presented in this WSPF.
- c. The seven solid samples were collected under a WAP certified program during the 3,100 m³ Project to satisfy "n", the calculated number of required waste containers to be sampled, were used as preliminary and as the required samples for this WSPF. The data were originally presented in INEEL/EXT-01-00015 in support of WSPF INW216.001 and are included in this WSPF in tables 2, 3, 3A, 4, and 4A
- d. No transformations were performed on this data set because there were not a sufficient number of detects in any of the sample sets.

Statistics Performed by:

Signature

Date:

9/17/04

Characterization Information Summary

Table 4B. Total SVOC Summary data – tentatively identified compounds.^a

Tentatively Identified Compound	Maximum Observed Estimated Concentrations (mg/kg)	# Samples Containing TIC	% Detected
Bis(2-ethylhexyl)phthalate ^b	3.5	6	86%
Fluoranthene ^b	9.5	3	43%
Pentachlorobenzene	0.36	1	14%
Phenanthrene	1.1	2	28% ^c
Phenol	0.67	1	14%
Phenol,2-Nitro	0.4	1	14%
Pyrene	0.2	1	14%
Did the Data verify the Acceptable Knowledge Yes <u> ✓ </u> No <u> </u>			
If no, describe the basis for assigning the EPA Hazardous Waste Codes: N/A			

^a Homogeneous Solids sample analysis data collected and analyzed under a certified program authorized by memorandum CBFO:NTP:KWW:VW:01-1022:UFC:5822 from Dr. Ines R. Triay to Ms. Beverly Cook, titled INEEL Certification Authority for Transportation and Characterization of Homogeneous Solid (S3000) Waste, dated May 18, 2001. The data used in support of WSPF INW216.001 is being presented in this WSPF.

^b Both of these constituents are on the 40 CFR Part 261 Appendix VIII list and exceed 25% within the waste stream. Both constituents have either K codes (Hazardous waste from specific sources) or U codes (discarded commercial chemical products). These K and U codes are not applicable to waste generated at the Rocky Flats Plant, therefore the detection of these TICs does not result in additional HWNs. These constituents will be added to the target analyte list for future analysis of First/Second Stage Sludge waste.

^c The % detected for phenanthrene was incorrectly reported as 18% in the initial WSPF BNINW216. Phenanthrene is not listed in 40 CFR Part 261 Appendix VIII, therefore no further action is required for this constituent.

Characterization Information Summary

Table 5. Correlation of container identification numbers to data package.

Container Number	Headspace Gas Sampling Data Package	RTR Data Package	RA Data Package	Visual Examination Data Package	Solid Sampling Data Package	Solid Analysis Data Package ^b
IDRF741200655 ^a	N/A	N/A	N/A	N/A	N/A ^c	ACL00004
IDRF741201882 ^a	N/A	N/A	N/A	N/A	N/A ^c	ACL00003
IDRF741202121 ^a	N/A	N/A	N/A	N/A	N/A ^c	ACL00003
IDRF741202216 ^a	N/A	N/A	N/A	N/A	N/A ^c	ACL00004
IDRF741202390 ^a	N/A	N/A	N/A	N/A	N/A ^c	ACL00004
IDRF741205311 ^a	N/A	N/A	N/A	N/A	N/A ^c	ACL00004
IDRF741205324 ^a	N/A	N/A	N/A	N/A	N/A ^c	ACL00004
10000135	HSG03-00290	RTR03-00001	ASY03-00306	N/A	N/A	N/A
10000147	HSG03-00316	RTR03-00005	ASY03-00259	N/A	N/A	N/A
10000161	HSG03-00282	RTR03-00007	ASY03-00104	N/A	N/A	N/A
10000162	HSG03-00282	RTR03-00007	ASY03-00105	N/A	N/A	N/A
10000171	HSG03-00291	RTR03-00001	ASY03-00307	N/A	N/A	N/A
10000299	HSG03-00297	RTR03-00017	ASY03-00357	N/A	N/A	N/A
10000353	HSG03-00287	RTR03-00017	ASY03-00309	N/A	N/A	N/A
10000379	HSG03-00312	RTR03-00060	ASY03-00261	N/A	N/A	N/A
10000461	HSG03-00310	RTR03-00026	ASY03-00271	N/A	N/A	N/A
10000464	HSG03-00311	RTR03-00026	ASY03-00272	N/A	N/A	N/A
10000472	HSG03-00312	RTR03-00028	ASY03-00266	N/A	N/A	N/A
10000474	HSG03-00313	RTR03-00028	ASY03-00266	N/A	N/A	N/A
10000478	HSG03-00313	RTR03-00028	ASY03-00266	N/A	N/A	N/A
10000490	HSG03-00312	RTR03-00028	ASY03-00266	N/A	N/A	N/A
10000492	HSG03-00311	RTR03-00028	ASY03-00272	N/A	N/A	N/A

- a. For drums not characterized by AMWTP, only the solids data will be presented in the WSPF, and these drums will not be entered into WWIS.
- b. An ACL Solids Data Package is composed of four separate reports. For example, ACL00004 contains ACL00004M, ACL00004N, ACL00004S, and ACL00004V.
- c. Solid sampling data have not been reevaluated by AMWTP. The solids data set being used to support this waste stream profile form was the one used to support the 3100 m³ WSPF for INW216.001. Solid sampling data package information was not presented in INW216.001.

Characterization Information Summary

Table 6. RTR/VE summary of prohibited items and AK confirmation.

Container Number	RTR Prohibited Items ^a	Visual Examination Prohibited Items ^a	AK Confirmation ^{b,c}
10000135	None	N/A ^d	Complete
10000147	None	N/A	Complete
10000161	None	N/A	Complete
10000162	None	N/A	Complete
10000171	None	N/A	Complete
10000299	None	N/A	Complete
10000353	None	N/A	Complete
10000379	None	N/A	Complete
10000461	None	N/A	Complete
10000464	None	N/A	Complete
10000472	None	N/A	Complete
10000474	None	N/A	Complete
10000478	None	N/A	Complete
10000490	None	N/A	Complete
10000492	None	N/A	Complete

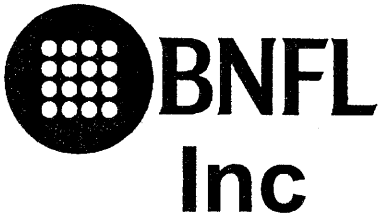
- a. See Table 5 for the associated RTR and Visual examinations. None of the listed containers contain prohibited items as defined by Section B-1c of the Advanced Mixed Waste Treatment Project Quality Assurance Project Plan (QAPjP), MP-TRUW-8.2.
- b. Acceptable Knowledge confirmations for RTR and visual examinations are conducted by an Acceptable Knowledge Expert on every drum by completing a checklist for each RTR and visual batch. This checklist can be accessed through the batches listed in Table 5.
- c. None of these drums have a VE in lieu of RTR examination.
- d. N/A indicates that a visual examination was not conducted on the container. None of the containers presented in this WSPF have been selected for visual examination by AMWTP.
- e. The absence of prohibited items is determined and documented through acceptable knowledge and confirmation activities. Radiography or visual examination is performed on each container in this waste stream as a confirmation activity.

Characterization Information Summary

Table 7. Sample identification number cross-correlation table.

Container Number	Headspace Gas Sample Number ^a	Solidified Sample Number(s)
IDRF741200655	N/A	ID02938811M1, ID02938811V1, ID02938811V2
IDRF741201882	N/A	ID02261811M1, ID02261811V1, ID02261811V2
IDRF741202121	N/A	ID01047411M1, ID01047411V1, ID01047411V2
IDRF741202216	N/A	ID02298211M1, ID02298211V1, ID02298211V2
IDRF741202390	N/A	ID03157311M1, ID03157311V1, ID03157311V2
IDRF741205311	N/A	ID00208611M1, ID00208611V1, ID00208611V2
IDRF741205324	N/A	ID00381811M1, ID00381811V1, ID00381811V2
10000135	HSG03-00290B9	N/A
10000147	HSG03-00316B11	N/A
10000161	HSG03-00282C4	N/A
10000162	HSG03-00282C5	N/A
10000171	HSG03-00291C7	N/A
10000299	HSG03-00297C8	N/A
10000353	HSG03-00287C5	N/A
10000379	HSG03-00312B15	N/A
10000461	HSG03-00310B8	N/A
10000464	HSG03-00311C10	N/A
10000472	HSG03-00312B14	N/A
10000474	HSG03-00313C14	N/A
10000478	HSG03-00313C11	N/A
10000490	HSG03-00312B13	N/A
10000492	HSG03-00311C6	N/A

- a. The AMWTP headspace gas unit is an on-line sampling and analysis system. The analysis events are sequentially numbered within each batch, but the sample number is not a unique number. The number presented in this table is a combination of the batch number (HSG03-00290) and the sequential instrument ID used in the batch for reporting (B9). This combination is unique and will allow traceability back to the data as collected and reported.



BNFL-5232-RPT-TRUW-09

Revision 2

**Acceptable Knowledge Summary
For
First/Second Stage Sludge**

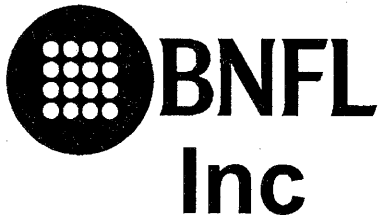
BNFL Inc.

September 16, 2004

Chris P. Schwensberg *Sept. 16th, 2004*

Approved (Signature/Date)

Next Periodic Review: 03/04/05



BNFL-5232-RPT-TRUW-09

Revision 2

**Acceptable Knowledge Summary
For
First/Second Stage Sludge**

BNFL Inc.

September 16, 2004

Eric Schweinsberg (Signature on File/September 16, 2004)

Approved (Signature/Date)

Next Periodic Review: 03/04/05

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LIST OF ACRONYMS AND ABBREVIATIONS

AK	acceptable knowledge
AMWTP	Advanced Mixed Waste Treatment Project
BBWI	Bechtel BWXT Idaho, LLC
CH	contact-handled
CPR	combustibles, plastic, and rubber
Cm	Curium
Cs	Cesium
DU	depleted uranium
EPA	Environmental Protection Agency
EU	enriched uranium
FR	Federal Regulations
HWN	hazardous waste number
IDC	item description code
INEEL	Idaho National Engineering and Environmental Laboratory
K	potassium
NDA	non-destructive assay
Np	neptunium
PCB	polychlorinated biphenyl
Pu	plutonium
PVC	poly vinyl chloride
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environmental Technology Site
RTR	real-time radiography
Sr	strontium
SWB	standard waste box
TDOP	ten-drum overpack
TRUCON	TRUPACT-II Content Code
TWBIR	Transuranic Waste Baseline Inventory Report
U	uranium
WAC	Waste Acceptance Criteria
WAP	Waste Analysis Plan (Attachment B of the WIPP Hazardous Waste Permit)
WIPP	Waste Isolation Pilot Plant
WMC	Waste Matrix Code
WSPF	Waste Stream Profile Form

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CROSS REFERENCE TABLE

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INEEL reference numbers used in the *Acceptable Knowledge Document for INEEL Stored Transuranic Waste – Rocky Flats Plant Waste*, Revision 3, INEL-96/0280 AMWTP P368A in Section 23.0, First/Second Stage Sludge, are listed in the table below. The AMWTP reference numbers corresponding to the INEEL reference numbers provide a crosswalk for the reader to the applicable AMWTP source document.

INEEL Ref No.	AMWTP Ref No.	INEEL Ref No.	AMWTP Ref No.	INEEL Ref No.	AMWTP Ref No.
C031	C031A	P052	P052A	P219	P219A
C063	C063A	P053	P053A	P226	P226A
C065	C065A	P061	P061A	P227	P227A
C154	C154A	P062	P062A	P240	P240A
C175	C175A	P065	P065A	P280	P280A
C184	C184A	P068	P068A	P303	P303A
C196	C196A	P076	P076A	P321	P321A
C200	C200A	P077	P077A	P322	P322A
C202	C202A	P078	P078A	P323	P358A
C203	C203A	P079	P079A	P324	P359A
C208	C208A	P080	P080A	U029	U029A
C224	C224A	P109	P109A	U030	U030A
P001	P001A	P113	P113A	U043	U043A
P004	P004A	P122	P122A	U047	U047A
P012	P012A	P124	P124A	U053	U053A
P013	P013A	P125	P125A	U059	U059A
P014	P014A	P126	P126A	U060	U060A
P015	P015A	P141	P141A	U092	U092A
P016	P016A	P164	P164A	U093	U093A
P022	P022A	P189	P189A	U104	U104A
P024	P024A	P194	P194A		
P033	P033A	P198	P198A		
P042	P042A	P200	P200A		
P043	P043A	P217	P217A		

Acceptable Knowledge Summary First/Second Stage Sludge

1. WASTE STREAM DESCRIPTION

1.1 Waste Stream Number

BNINW216

1.2 Basic Waste Stream Information

1.2.1 Waste Stream Name

First/Second Stage Sludge

1.2.2 Point of Generation

Rocky Flats Plant - Liquid Waste Treatment Area of Building 774

1.2.3 Waste Stream Volume⁴

21,304 Containers (4431 m³)

IDC 001: 9,440 containers (1964 m³)

IDC 002: 11,786 containers (2,451 m³)

IDC 800: 78 containers (16 m³)

1.2.4 Generation Dates⁴

1969 – 1988 (Advanced Mixed Waste Treatment Project [AMWTP] facility has confirmed containers of waste from 1971 – 1988. Based on some inventory data, AMWTP has some waste packaged as early as 1969. The waste in the years 1969 and 1970 contain some First/Second Stage Sludge based on inventory information with container prefixes and weights consistent with those expected for First/Second Stage Sludge. This will be confirmed during retrieval and characterization activities.)

1988 – Present: Package dates later than 1988 will be associated with some containers. These more recent package dates are the result of repackaging activities (i.e., visual examinations, intrusive sampling, or liquid absorption activities). There is no additional First/Second Stage sludge generation occurring at the INEEL.

1.2.4.1 IDC Specific Generation Dates⁴

IDC 001: 1969 through 1986 (AMWTP facility has confirmed containers of waste from 1971 – 1986.)

IDC 002: 1969 through 1985 (AMWTP facility has confirmed containers of waste from 1971 – 1985.)

IDC 800: 1985 through 1988 (AMWTP facility has confirmed containers of waste from 1985 – 1988.).

1.2.5 TRUCON Codes^{3, 5, 6}

ID111A, ID211A

ID111C, ID211C (Standard waste boxes [SWBs] only)

ID111D, ID211D

1.2.6 TWBIR Information⁸

IN-W216.875, IN-W216.98, IN-W216.99

IN-W228.101, IN-W228.102, IN-W228.103, IN-W228.883

1.2.7 Summary Category Group^{3, 7}

S3000 Homogeneous Solids

1.2.8 Waste Matrix Codes^{3, 7}

S3121 – Waste Water Treatment Sludge (IDC 001, IDC 002)

Waste Matrix Code (WMC) S3121 consists of >50% by volume secondary sludge, or filtercake from wastewater treatment processes or heavy metal sludges resulting from recovery processes.

S3150 – Solidified Homogeneous Solids (IDC 800)

WMC S3150 consists of >50% by volume solidified forms. An example is sludge waste that is immobilized with cement and cured into a solidified form.

Two waste matrix codes have been assigned to this waste stream because the immobilization process for this waste stream was changed in 1986. Prior to 1986 the first/second stage sludge was placed into a drum with Portland cement. The excess liquid was immobilized but a solid monolith was not formed. Subsequent to 1986 the sludge was co-fed into a drum with a diatomite and Portland cement mixture, which formed a solid monolith after curing.

1.2.9 Waste Matrix Code Group

S3100 – Inorganic Homogeneous Solids

1.3 Waste Stream Description

1.3.1 Description

The First/Second Stage Sludge waste stream consists of drums containing First Stage Sludge (Item Description Code [IDC] 001), Second Stage Sludge (IDC 002); or Solidified Sludge – Bldg 774 (IDC 800).

Table 1-1. Physical Waste Form Descriptions for First/Second Stage Sludge.

TWBIR Number(s)	IDC	WMC	Description
IN-W216.875 IN-W216.98 IN-W216.99	001	3121	This waste consists of immobilized materials generated from first-stage treatment operations in Rocky Flats Plant (RF) Building 774. Aqueous liquids coming into the process originated from Building 771 recovery operations. The liquids were made basic with sodium hydroxide to precipitate iron, magnesium, etc. that also carried down the relatively small precipitate of plutonium and americium hydrated oxides. The precipitate was filtered to produce a sludge (IDC 001), which was placed in a drum with Portland cement. Beginning in 1979, sludge waste from second-stage treatment was combined with first-stage sludge. The combined sludges were also assigned IDC 001. IDC 001 was discontinued in 1986 when the immobilization process changed, and has since been assigned IDC 800.
IN-W228.101 IN-W228.102 IN-W228.103 IN-W228.883	002	3121	This waste consists of immobilized materials generated from second-stage treatment operations in RF Building 774. Aqueous liquids to be treated originated from first-stage treatment and from numerous buildings on plant site. The liquids were treated in the same manner as the liquids from the first stage, and the resulting sludge (IDC 002) was placed into a drum with Portland cement. Prior to 1973, second-stage sludge may contain miscellaneous debris, as identified by visual examination and RTR inspections of IDC 002 containers. The following types of debris have been examined: Cellulosic debris, Plastic debris, Leaded rubber gloves, Rubber debris ¹⁸ , Rubber gloves, and Metal debris. AK indicates that up until 1973 items such as the following may have been present in second stage sludge (IDC 002). These items have not been confirmed through characterization activities and are as follows: electric motors, bottles containing residual liquid chemical wastes and mercury, mercury batteries, and lithium batteries.
IN-W216.875 IN-W216.98 IN-W216.99 IN-W228.101 IN-W228.102 IN-W228.103 IN-W228.883	800	3150	The process that produced sludge from RF Building 774 (IDC 800) was the same process as that which generated IDC 001. The difference between the two IDCs was the immobilization process. For IDC 800, the sludge was co-fed into a drum with a diatomite and Portland cement mixture, which formed a solid monolith after curing. IDC 800 is most accurately described by the combination of TWBIR numbers for IDC 001 and IDC 002, therefore all TWBIR numbers associated with IDC 001 or IDC 002 were applied to IDC 800.

In accordance with Attachment B of the Waste Analysis Plan (WAP), a waste stream is defined as waste material generated from a single process or from an activity that is similar in material, physical form, and hazardous constituents. The aqueous sludge wastes from Building 774 were generated from a carrier precipitation and immobilization process and are similar in material and physical form (sludge mixed with diatomite and Portland cement). The feed streams to the process did not change appreciably over time, and therefore the cemented sludge wastes are similar in hazardous constituents.

1.4 Process Description

1.4.1 Areas of Operation

When Building 774 was built in 1952, its primary purpose was to treat radioactive aqueous waste from Building 771. Later, aqueous wastes from numerous buildings on plant site were treated in Building 774. Production and production support processes in Buildings 371, 444, 447, 559, 707, 771, 776, 777, 779, 865, and 883 generated liquid wastes which were treated in Building 774. Building 774 was a combination batch continuous processing operation with a two-stage carrier precipitation process. Aqueous liquid wastes were treated using neutralization, precipitation, flocculation, and clarification processes. The settled solids were then filtered and immobilized.

1.4.2 Waste Generating Process

Most of the aqueous wastes from Building 771 entered the Building 774 liquid waste processing facility by vacuum transfer through the process waste system.

Acid wastes containing large quantities of metal ions that were insoluble in basic solutions, or chloride ions that were corrosive to the process equipment, were neutralized with sodium hydroxide (between 2.5 and 12). The purpose of this process was to remove the metal hydroxide solids prior to the succeeding flocculation and clarification processes. The precipitated solids were sent through vacuum filtration.

Acid waste containing only small quantities of metal ions that were insoluble in basic solutions and caustic wastes containing large quantities of un-dissolved solids were mixed with ferric sulfate and calcium chloride reagents and the pH adjusted as necessary with sodium hydroxide. The solids (mainly ferric hydroxide) settled to the bottom of the tank, and the liquid was decanted into the feed tank for the succeeding precipitation and clarification process. The solids were sent through vacuum filtration.

Liquid waste solutions that were relatively free of solids were mixed with the decanted solution from the previously described batch precipitation processes and the filtrate from the rotary drum vacuum filter. These combined wastes were drained into a flash mixer tank where the decontaminating chemical reagents were introduced. The mixture from the flash mixing vessel flowed into the flocculator where anionic polyelectrolyte flocculent (PuriFloc A23^{36,37}) was added. The mixture then flowed into the clarifier where the floc was allowed to settle out. The clarifier supernatant liquid was pumped to the second stage treatment process. The precipitate at the bottom of the tank flowed into the slurry tank awaiting vacuum filtration.

Slurry from the first stage treatment was drawn through diatomite filter media by a vacuum inside a rotating filter drum. The filter media and trapped solids were continually scraped off the drum filter and fed into a 55-gallon drum. Portland cement was added to the

bottom of the drum prior to placing sludge into the drum. Portland cement may also have been added on top of the sludge.

The slurry from second stage was kept separate from the first stage slurry up until 1979 (IDC 002). Even during this time frame, there was commingling of liquids between the two stages. The effluent from the first stage process required further treatment by second stage process, and the filtrate from the rotary drum vacuum filter was fed back to first stage treatment. Beginning in 1979, slurry from the first and second stage treatment was combined prior to filtration. The combined sludge was assigned IDC 001.

Treated effluent from the first stage processes, filtrate from the second stage vacuum filter, liquids from the waste treatment process drains, and other wastes from numerous other buildings were received into second stage treatment. In the batch radioactive decontamination process, ferric sulfate and calcium chloride reagents were added, and a flocculating agent was also added near the end of the mixing cycle. The supernatant liquid was decanted into treated waste holding tanks. The floc that settled to the tank bottom was then sent through vacuum filtration.

The continuous radioactive decontamination process accepted low chemical content process wastes, primarily water and detergent from the laundry facility. This process was identical in process chemistry to first stage treatment. The treated liquid was pumped into holding tanks. The settled solids were sent through vacuum filtration.

In a process identical to first stage sludge, slurry from the second stage treatment was drawn through diatomite filter media by a vacuum inside a rotating filter drum. The filter media and trapped solids were continually scraped off the drum filter and fed into a 55-gallon drum. Portland cement was added to the bottom of the drum prior to placing sludge into the drum. During processing of second stage sludge, several layers of cement may have been added between layers of sludge. Portland cement may have also been added to the top of the sludge.

Beginning in 1979, slurry from first and second stage treatment was combined prior to filtration, and the sludge was assigned IDC 001.

In 1986, the process for immobilizing first and second stage sludges was changed. Sludge waste generated under the new immobilization process was assigned IDC 800. Processing of first and second stage sludges through treatment, precipitation, and filtration did not change. However, as the sludge was scraped off the drum filter, it was co-fed into a drum with a diatomite and Portland cement mixture which formed a solid monolith after curing. Assignment of IDC 001 was discontinued at this time.

1.4.3 Process Flow Diagram

See Figure 3-1.

1.4.4 Material Inputs/Waste Material Parameters

1.4.4.1 Material Inputs - RF IDC 001

The most common wastes that entered first stage treatment were:

- Plutonium ion column effluent
- Americium ion column effluent
- Thiocyanate waste solution

- Caustic scrubber solution
- Part V waste solutions (nitric, sulfuric, and hydrofluoric acids)
- Nitric acid distillate from feed evaporator
- Water distillate from peroxide precipitation filtrate evaporator
- Steam condensate

The following compounds were used during recovery operations in Building 771 and may be present in IDC 001.

- | | |
|-----------------------|-----------------------|
| • Nitric Acid | • Magnesium |
| • Aluminum nitrate | • Sodium peroxide |
| • Calcium fluoride | • Potassium iodate |
| • Potassium hydroxide | • Hydrogen fluoride |
| • Ferrous sulfamate | • Sodium nitrate |
| • Sulfuric acid | • Hydrochloric acid |
| • Hydrogen peroxide | • Hydrofluoric acid |
| • Calcium | • Sodium hypochlorite |
| • Magnesium oxide | • Potassium fluoride |

Aqueous wastes containing complexing agents were handled separately and were not mixed with these aqueous waste streams.

1.4.4.2 Material Inputs - RF IDC 002

Second stage treatment handled liquids that were treated by first stage treatment, decanted liquids from Tank 40 (slurry holding tank), and low-level or nonradioactive aqueous process wastes from numerous buildings on plant site. Most of the wastes transferred to second stage treatment by the process waste system were only accepted until August 1984 when the precipitation process in Building 374 went on line. After that time, the wastes from Buildings 771 and 774 given below continued to be transferred to Building 774 second stage treatment through the process waste system. Wastes from the remaining buildings also continued to be sent to Building 774 by tanker after August 1984.

Table 1-2. Wastes feeding Second Stage Sludge treatment.

Source Building	Materials
111	Process liquid waste
122	Medical decontamination wash down
123	Acidic solutions, process waste water, and standards and sample waste
331	Filter sludge and antifreeze solution
334	Ammonium persulfate, copper sulfate, etchants, and cleaners
371	Ammonia hydroxide, potassium hydroxide, and process waste water
443	Lithium chloride solution and water treatment additives
444	Process waste water (acidic), waste plating acid
447	Process waste water
460	Process waste water
551	35% hydrogen peroxide, high in tin content

Source Building	Materials
553	Sulfuric acid, baking soda, calcium chloride
559	Standards, caustic scrubber solution, acid wastes, and process waste water
690	Acid solutions
705	Ox Out 536 (water, ammonium bifluoride, and nitric acid) ³⁵
707	Calcium fluoride solution and acid solutions
750	Hydrochloric acid and trisodium phosphate
771	Process waste water (residual chemicals, blow down water, decon water)
774	Floor wash down and silver recovery effluent
776	Ammonia hydroxide, ethanol, hexane, acid solutions, and process waste water
778	Laundry waste water, suma cleaner (acid bath/nitric acid) ³¹ , and rinse water/battery acid
779	Acidic and basic solutions and process waste water
865	Acid solutions, scrubber effluent, polishing solution, and process waste water
881	Acid solutions, standards, samples, ammonium chloride, and process waste water
883	Acid solutions, Ox Out 536 (water, ammonium bifluoride, and nitric acid) ³⁵ , and process waste water
886	Ferric chloride, detergents, and process waste water
889	Equipment decontamination water
991	Acidic and basic solutions and water samples

1.4.4.3 Material Inputs – RF IDC 800

Inputs for solidified sludge are the same as those for first stage sludge and second stage sludge described above.

1.4.4.4 Miscellaneous Items

Miscellaneous items are those items that have been identified during characterization activities that are not consistent with expectations based on process descriptions. They appear in a small percentage of the waste stream containers and constitute a small percentage of the waste within the container and summary category group and other determinations are not impacted.

Visual examination and Real-Time Radiography (RTR) inspections of RF IDC 001 containers have identified the following items:

- Cellulosic debris
- Plastic debris
- Leaded rubber gloves and aprons
- Rubber debris¹⁸, Rubber gloves
- Metal Debris
- Filters (metal alloy and cellulosic)
- Inorganic liquid (see section 1.5)

Visual examination and RTR inspections of IDC 002 containers have identified the following items:

- Cellulosic debris
- Plastic debris
- Leaded rubber gloves
- Rubber debris¹⁸, Rubber gloves
- Metal debris
- Inorganic liquid (see section 1.5)

AK indicates that up until 1973 items such as the following may have been present in second stage sludge (IDC 002). These items have not been confirmed through characterization activities.

- electric motors
- bottles containing residual liquid chemical wastes and mercury
- mercury batteries
- lithium batteries
- radioactive sources (until 1979)

Visual examination and RTR inspections of IDC 800 containers have identified the following items:

- Cellulosic debris
- Plastic debris
- Leaded rubber gloves
- Lead tape
- Rubber debris¹⁸, Rubber gloves
- Metal bolt
- Inorganic liquid (see section 1.5)

1.4.4.5 Waste Material Parameters

Table 1-3. Waste material parameters for First Stage Sludge (RF IDC 001).

Potential Waste Material Parameter	Description
Steel (packaging material)	55-gallon drum
Plastics (packaging material)	90 mil drum liner, O-ring bag, drum bag, filtered bag, drum stub bags, poly bottles ²⁹ , poly bags ²⁹
Other Inorganic Materials	Portland cement ^{a,b} , vermiculite, Oil-Dri ^{®b} , Aquaset ^{®b}
Other Metals	Lead sheets or lead tape
Iron-based metals/alloys	Metal cans ²⁹
Inorganic Matrix	First Stage Sludge
<p>^a. The presence of Portland cement may not be detected since the majority of the Portland cement will be located at the bottom of the drum. Weights reported by both RTR and visual examination are expected to include most of the Portland cement as Inorganic Matrix.</p> <p>^b. See Section 2.5 for chemical description of Trademark Names.</p>	

Table 1-4. Waste Material Parameters for Second Stage Sludge (RF IDC 002).

Potential Waste Material Parameter	Description
Steel (packaging material)	55-gallon drum
Plastics (packaging material)	90 mil drum liner, O-ring bag, drum bag, filtered bag, drum stub bag
Other Inorganic Materials	Portland cement ^{a,b} , Oil-Dri ^{®b} , vermiculite, Aquaset ^{®b}
Other Metals	Lead sheets or lead tape, electric motors, batteries
Inorganic Matrix	Second Stage Sludge
<p>^a The presence of Portland cement may not be detected since the majority of the Portland cement will be located at the bottom of the drum and layered throughout. Weights reported by both RTR and visual examination are expected to include most of the Portland cement as Inorganic Matrix.</p> <p>^b See Section 2.5 for chemical description of Trademark Names.</p>	

Table 1-5. Waste material parameters for Solidified Sludge – Bldg 774 (RF IDC 800).

Potential Waste Material Parameter	Description
Steel (packaging material)	55-gallon drum
Plastics (packaging material)	90 mil drum liner, O-ring bag, drum bag, filtered bag, drum stub bag
Other Inorganic Materials	Vermiculite, Aquaset ^{®a}
Inorganic Matrix	Solidified Sludge – Bldg 774
<p>^a See Section 2.5 for chemical description of Trademark Names.</p>	

1.5 Prohibited Items

The absence of prohibited items is determined and documented through acceptable knowledge and historical confirmation activities. The following item is expected in this waste based upon the above review.

- Liquid waste (waste shall contain as little residual liquid as is reasonably achievable by pouring, pumping and/or aspirating, and internal containers shall contain less than 1 inch or 2.5 centimeters of liquid in the bottom of the container. Total residual liquid in any payload container (e.g., 55 gallon drum or standard waste box) may not exceed 1 percent volume of that container)

The following items have been determined as not present in this waste through review of the AK record.

- Non-radionuclide pyrophoric materials, such as elemental potassium
- Hazardous wastes not occurring as co-contaminants with TRU mixed wastes (non-mixed hazardous wastes)
- Wastes incompatible with backfill, seal and panel closure materials, container and packaging materials, shipping container materials, or other wastes

- Wastes containing explosives or compressed gases
- Wastes with polychlorinated biphenyls (PCBs) not authorized under an EPA PCB waste disposal authorization
- Wastes exhibiting the characteristic of ignitability, corrosivity, or reactivity (EPA Hazardous Waste Numbers of D001, D002, or D003)

Excess residual liquid is a common prohibited item identified during RTR and visual examination in this waste stream. Other prohibited items are expected to be very rare.¹ Drums with excess residual liquid will be treated by adding absorbent prior to shipment. Drums with other prohibited items will be treated or rejected as appropriate. Drums with prohibited items will not be part of the waste stream shipped to WIPP.

1.6 RCRA Determination

1.6.1 EPA Hazardous Waste Numbers²

Toxicity Codes: D004, D005, D006, D007, D008, D009, D010, D011, D022

Listed Codes: F001, F002, F003, F005, F006, F007, and F009

1.6.2 Hazardous Determination

Ignitability:

The waste is a solid and does not meet the definition of ignitability (D001) as defined in 40 CFR 261.21. Originally the generator (RF) assigned the F003 code for the non-halogenated, non-toxic F003 constituents (acetone, methanol, and xylene). These compounds are listed for their ignitability. The source wastes containing the F003 constituents were not mixed with any other listed (F001, F002, F004, or F005) constituents or wastes at the point of generation in the laboratory. None of the F003 compounds had a 90% confidence level in either the headspace gas samples or the solid samples greater than the PRQL, but all of the compounds except for methanol were detected in one or more of the headspace gas samples for these drums. Methanol and xylene were both detected in one or more solid samples.⁵ The F003 waste streams also were discarded into the Process Waste Transfer System (PWTS) as non-hazardous wastewaters, i.e., diluted with water and flushed at the point of generation. Therefore, it was determined during the 3,100 m³ Project that the F003 waste was rendered non-ignitable prior to subsequent discharge and aggregation within the liquid waste stream destined for sludge generation.

Corrosivity:

Under 40 CFR 261.22, a solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties:

- It is aqueous with a pH less than or equal to 2, or greater than or equal to 12.5, as determined by a pH meter using Method 9040 in "Test Methods for Evaluating Solid Waste, Physical and Chemical Methods," EPA Publications SW-846.
- It is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.240 inch) per year at a test temperature of 55 degrees Celsius (130 degrees Fahrenheit) as determined by its test method specified in National Association of Corrosion Engineer (NACE) Standard TM-01-69 as standardized in SW-846.

The waste stream does not meet the characteristic of corrosivity (D002) as defined. The waste is not an aqueous liquid. As has been determined by radiography and VE, none of the drums to be shipped contain 20% by volume, aqueous waste. Since 20% by volume is required in order to measure pH, the corrosive characteristic does not apply.

The First/Second stage sludge waste stream does not meet the definition of liquid in making a determination of corrosivity toward steel because the waste is not a liquid. A knowledge-based determination is allowable when determining whether or not the waste stream is a liquid relative to corrosivity under the Federal Register (FR), 50 FR 18372, dated April 30, 1985. It is stated in the FR, "EPA believes that, for the purposes of the characteristic of ignitability and corrosivity, it will generally be obvious whether or not the waste is a liquid." Residual liquid may be present in some drums, but only drums with liquids below the WIPP waste acceptance criteria (WAC) ceiling will be shipped to WIPP.

Reactivity:

The waste stream does not meet the characteristic of reactivity (D003) as defined under RCRA 40 CFR 261.23. The waste materials are stable and will not react violently with water, form potentially explosive mixtures with water, or generate toxic gases, vapors or fumes when mixed with water. The materials do not contain sulfides and are not capable of detonation or explosive reaction.

The waste may contain trace quantities of cyanide derived from electroplating wastes, and containers with residual amounts of liquid chemical wastes added to the process waste stream (as opposed to piped waste water). Only trace amounts of cyanide are expected in the waste stream feed and would not cause the resulting waste to be reactive. Based on the levels of concentration of cyanide in the feed waste, the alkalinity of the sludges (9 to 11 pH) and the presence of metals (e.g., Fe^{+3} , Cu^{+2} , Al^{+3}), cyanide is not available for release because all free cyanide exists as stable metal complexes.

Second-stage sludge generated before 1973 may contain lithium batteries. However, the batteries are spent/used and therefore not reactive. The following rationale support the decision to not assign EPA hazardous waste codes D003 (reactivity) or D001 (ignitability) to this waste stream due to the potential presence of lithium batteries.²⁵

- Lithium metal, which is highly reactive with water, was used as an anode in lithium alkaline batteries. As the battery discharges, the lithium metal is converted to lithium oxide, which is not reactive. The materials in this waste group are therefore neither ignitable (D001) nor reactive wastes (D003) due to the potential presence of batteries.
- Considering the cost of lithium batteries in this time frame (pre-1973), there is no reason a user would replace and discard a lithium battery until the voltage dropped. One of the important features of lithium batteries is the constant voltage (i.e., flat discharge curve), which lasts until all of the lithium has been converted into a non-reactive lithium compound. At that time, virtually none of the lithium is present in the reactive metallic state and there is a sharp voltage drop.
- The lithium contained in batteries present in the 1969-1973 generated second stage sludge waste is no longer reactive or ignitable. According to battery manufacturer information, current lithium batteries have shelf lives of approximately 10 to 20 years (early lithium batteries did not have shelf lives of this length). This is the period of time that it takes for a battery to lose its charge (discharge) due to the electrochemical reaction over time. As the result of discharge, the lithium metal is converted to

lithium oxide. By design lithium batteries are constructed with an excess of positive electrode material to assure that there is enough positive material to react with all of the metallic lithium present. Spent (discharged) lithium batteries do not contain lithium metal and are not toxic, not ignitable, nor reactive. Any battery in the pre-1973 drums is currently 29 years old or older. Based on shelf life, any batteries present have completely discharged.

The materials in the waste stream do not meet the definition of reactivity and will not be assigned the D003 waste code.

Toxicity:

Acceptable knowledge indicates the potential presence of metals, arsenic, barium, cadmium, chromium, lead, mercury (including mercury batteries), selenium, and silver in this waste stream. Results from sampling and analysis of the sludge (See Table 2 of the Characterization Information Summary) confirm that cadmium, chromium, lead, and silver are present in the waste stream in quantities that exceed the toxicity limit and that arsenic, barium, mercury and selenium also are present, but at levels less than the toxicity limit. Based on AK, the waste stream will be assigned all of the EPA codes for the metals including those metals with concentrations that did not exceed regulatory limits. EPA hazardous waste numbers for these metals are D004 through D011.

Toxicity characteristic organic constituents, tetrachloroethylene, trichloroethylene, carbon tetrachloride, chlorobenzene, chloroform, and benzene were identified in the acceptable knowledge baseline document as potential hazardous constituents present in First/Second Stage Sludge waste. Tetrachloroethylene, trichloroethylene, and carbon tetrachloride were used primarily for cleaning and degreasing. Although chlorobenzene and chloroform were not identified as being used at the RF site in AK source documents, both were detected in characterization samples from the waste as reported in the baseline AK document: chlorobenzene was detected in volatile organic compound analysis of a single sample of sludge with a totals concentration significantly less than the regulatory level; and chloroform was detected in headspace gas samples collected at the INEEL with a UCL₉₀ greater than the PRQL. Benzene was used as a solvent in laboratory operations.

First and Second Stage Sludge waste was generated from an aqueous waste treatment process and only trace amounts of the solvents listed above are present as shown by the waste stream data. Because these constituents were used as solvents and degreasers and all except chloroform are identified as F-listed, the waste is regulated as listed hazardous waste and not characteristic waste. Therefore, the toxicity characteristic waste codes associated with the F-listed constituents were not assigned to the waste.

Chloroform was the only toxicity characteristic organic compound with a 90% upper confidence limit (UCL₉₀) that exceeded the PRQL in headspace gas sampling done in support of the previous characterization activities for WSPF INW216.001. Other acceptable knowledge and solid sampling data did not indicate that chloroform was an expected constituent of the waste. The toxicity characteristic hazardous waste number D022 for chloroform is assigned to the waste as a conservative measure, although solids data does not exceed the PRQL for chloroform.

Based on AK and sampling data, D004-D011 and D022 have been assigned to this waste stream.

Listed Waste:**F Codes:**

Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, chlorobenzene, and 1,1,2-trichloro-1,2,2-trifluoroethane were commonly used for cleaning, degreasing or paint removal, and the sludges may contain residual amounts of these spent solvents. Headspace gas sampling (Table 1A of the Characterization Information Summary) supports the evaluation with the UCL_{90} for 1,1,1-trichloroethane above the PRQL. Sampling and analysis results for solids did not indicate the presence of any organic compounds above regulatory or program-required limits at the 90% upper confidence limit. Carbon tetrachloride, 1,1,1-trichloroethane, methylene chloride and tetrachloroethylene were all detected (above the minimum detection level) in solid samples taken from one or more of the drums (Table 3A of the Characterization Information Summary). The applicable EPA listed waste codes, F001 and F002, have been assigned to the waste stream based on AK as confirmed by sampling and analysis.

Acetone, benzene, butanol, ethyl benzene, ethyl ether, methanol, toluene, and xylene were used as solvents in laboratory operations. The aqueous waste transferred to Building 774 second-stage treatment may have contained small quantities of these spent solvents. Headspace gas samples did not have detections of these compounds with UCL_{90} s in either the headspace gas samples or the solid samples greater than the PRQL. Both methanol and xylene were detected in one or more of the solid samples.

Originally the generator (RF) assigned the F003 code for the non-halogenated, non-toxic F003 constituents (acetone, methanol, and xylene). These compounds are listed for their ignitability. The source wastes containing the F003 constituents were not mixed with any other listed (F001, F002, F004, or F005) constituents or wastes at the point of generation in the laboratory. The F003 waste streams also were discarded into the Process Waste Transfer System (PWTS) as non-hazardous wastewaters, i.e., diluted with water and flushed at the point of generation. Therefore, it was determined that the F003 waste was rendered non-ignitable prior to subsequent discharge and aggregation within the liquid waste stream destined for sludge generation, and the F003 code was not assigned to the waste. However, the 2,639 drums with analytical results from 3100 m³ Project do indicate that some drums have headspace gas results with detections of F003 constituents. Acetone was the most common of the F003 constituents with 2,271 drums with levels above the detection level. However the mean concentration was 4.24 ppmv and the UCL_{90} was 5.00, which is well below the PRQL of 100. After evaluation of the data and the AK for the waste stream and the containers, it was determined that detections of the F003 constituents in containers do not indicate a different waste population. The data confirms the presence of the F003 listed constituents predicted by AK. The concentrations detected do not render the waste ignitable, however the F003 HWN will be applied to the waste as a conservative measure and to comply with the WAP requirement that if an F-listed waste constituent is detected, the appropriate HWN shall be applied.

The presence of the F005 solvent benzene was confirmed by detects in headspace gas sampling. Toluene was also routinely detected in historical data for the 3100 m³ Project. Assignment of the F005 code is appropriate for this waste stream. EPA code assignments applicable to each analyte are included in Table 1A of the Characterization Information Summary.

Spent stripping, cleaning, and plating solutions from electroplating operations in which cyanides were used were treated in Building 774 up until 1982. The solidified aqueous wastes from this building were derived from the treatment of the hazardous electroplating wastes and are

assigned EPA hazardous waste codes F006, F007, and F009. Wastes generated after 1982 continue to carry the F006, F007, and F009 codes because the Building 774 treatment process was a RCRA permitted system that never went through closure.

Based on the above discussion First/Second Stage Sludge will be assigned F001, F002, F003, F005, F006, F007, and F009.

P and U Listed Codes:

The materials in this waste stream do not meet the definition for any P- or U-listed codes. P- and U-listed EPA codes only apply to discarded commercial chemical products, and residues of commercial chemical or off-specification products. The waste is not and does not contain any commercial product, or manufacturing chemical intermediate listed under paragraphs (e) or (f) of 40 CFR 261.33 that when they were discarded were mixed with waste oil or used oil or other material that was applied to the land, or used as a fuel, in lieu of their original intended use as described in detail in 40 CFR 261.33. Sludge waste containers may contain small amounts of mercury in internal containers. However, the related P- and U-listed codes are not applicable based on the rationale presented in the following paragraphs.

Acceptable knowledge and solid sampling and analysis data indicate the potential presence of trace amounts of beryllium (less than 1% by weight) in containers of First/Second Stage Sludge generated from both beryllium casting and machining. This beryllium contamination is an integral part of the sludge and is not in powder form. It is not a commercial chemical product, an off-specification species, a container residue, or a spill residue thereof. Therefore, the P-listed waste code (P015) for beryllium as defined in 40 CFR 261.33 was not assigned to the waste.

Acceptable knowledge indicates the presence of residual amounts of contaminated mercury in pint bottles in Second-Stage sludge containers generated prior to 1973. The mercury is described as "contaminated," which denotes that it was used and discarded as waste. According to the Backlog Waste Reassessment Baseline Book, the liquid chemical wastes were compatible wastes, not commercially pure grade chemicals.⁹ Therefore, the U listed code for mercury does not apply.

The U-listed code (U134) for hydrofluoric acid is not applicable to this waste stream. Hydrofluoric acid may have been used during recovery operations in Building 771, but was not disposed of as unused product within the waste stream. As established previously, this waste does not exhibit the characteristic for corrosivity.

The U-listed code (U079) for trans-1,2-dichloroethylene also is not applicable to this waste stream. It is not an expected constituent of this waste and the waste does not meet the definition of a U-listed waste per 40 CFR 261.33. Although trans-1,2-dichloroethylene is currently a WAP target analyte, it was not included as such in the solids sampling analytical results used to characterize this waste. As stated earlier, the solids samples were collected and analyzed under a WAP compliant program, but prior to the time that trans-1,2-dichloroethylene was added to the target analyte list. It was not detected (as a TIC) in any of the solid samples analyzed under the 3,100 m³ Project WIPP compliant program and has not been detected as a TIC in any of the RF wastes headspace gas samples in 25% or more of samples, including First/Second Stage Sludge.

In addition to the pipeline-transferred waste, wastes in containers that were compatible with the first and second stage treatment processes were treated in Building 774. Some of the wastes in containers exhibited hazardous characteristics. However, the EPA codes applicable to

these wastes did not include additional codes that were different from those cited for pipeline-transferred wastes. Therefore, no additional listed waste codes apply.

No discarded chemical products, off-specification compounds chemical residues, spill residues or hazardous waste from specific sources (40 CFR 261.32) were included in this waste stream. Therefore no K, U, or P listings have been applied to the First/Second Stage Sludge waste stream.

TSCA Regulated Contaminants

Acceptable knowledge indicates that the First/Second Stage Sludge Waste does not contain polychlorinated biphenyls (PCBs) as regulated by the Toxic Substances Control Act (TSCA), 15 U.S.C. 2601 et seq.

1.7 Radionuclides

The recommended default mass fraction values of the plutonium isotopes to be used as the AK based values and confirmed by BNFL during non-destructive assay (NDA) are listed in BNFL-5232-RPT-TRUW-07, *Determination of Radioisotopic Content in TRU Waste Based on Acceptable Knowledge*.¹²

Mass fraction values for ^{241}Am , ^{233}U , ^{235}U , and ^{238}U previously determined for Rocky Flats at the Idaho National Engineering and Environmental Laboratory (INEEL) were based on individual gamma spectrometric measurements. The ^{234}U activities were calculated based on ratios with depleted uranium isotopes. The criteria used for selection and the formulas for determining the ^{234}U mass are presented in BNFL-5232-RPT-TRUW-07.¹²

^{137}Cs was detected in Rocky Flats waste during AMWTP NDA confirmatory testing.¹⁵ ^{137}Cs and ^{90}Sr were known to have been used at Rocky Flats in small quantities during research and analytical activities, but were not expected to be present in detectable amounts or at levels that would require reporting. The presence of ^{90}Sr is predicated on the presence of ^{137}Cs , and its activity and mass are determined using a default ratio scaling factor based on ^{137}Cs .¹²

Radionuclides such as ^{244}Cm , ^{232}Th , and ^{236}U may be found in Rocky Flats wastes.¹² ^{241}Am , ^{234}U , and ^{237}Np are expected in most of the Rocky Flats TRU waste containers due to radioactive decay and ingrowth. ^{243}Am and ^{245}Cm , other isotopes resulting from radioactive decay, have also been detected during AMWTP NDA.^{20, 21} ^{40}K may be detected when other radionuclides in a container are significantly lower in concentration. In some cases ^{40}K has been detected in higher concentrations than ^{239}Pu and contributes to 95% of the radionuclide hazard.¹⁶

2. SHIPPING CONSIDERATIONS

2.1 Waste Packaging – RF IDC 001

2.1.1 Inner Packaging- RF IDC 001

The typical IDC 001 is a monolithic sludge placed directly into drum bags with no inner packaging.

2.1.2 Absorbent- RF IDC 001

The following absorbents were used at the time of waste packaging.

- 1969 – 1970: 3 to 5 pounds of Portland cement (See Section 2.5) at bottom of drum²⁶
 3 to 5 pounds of Portland cement (See Section 2.5) in the bottom of drum bag²⁶
 3 to 5 pounds of Portland cement (See Section 2.5) on top of sludge in inner poly bag²⁶
 ~5 pounds of Portland cement (See Section 2.5) on top of outer poly bag²⁶
 Portland cement (See Section 2.5) layered throughout the drums²⁶
- 1971 – 1986: 3 to 5 pounds of Portland cement (See Section 2.5) at bottom of drum (1971-72)
 Portland cement (See Section 2.5) placed in bottom of rigid liner (1972-86)
 3 to 5 pounds of Portland cement (See Section 2.5) in the bottom of drum bag
 ~30 pound of Portland cement (See Section 2.5) in the bottom of the poly vinyl chloride (PVC) O-ring bag
 3 to 5 pounds of Portland cement (See Section 2.5) on top of sludge in O-ring bag (1983-86)
 ~5 pounds of Portland cement (See Section 2.5) on top of O-ring bag
- 1971 – 1982: 1 to 2 quarts of Oil-Dri® (See Section 2.5) on top of outer, sealed polyethylene bag. A small number of containers have been identified with container within container packaging. During maintenance cleanout operations First Stage Sludge was removed from tanks and equipment and placed into smaller containers (poly bottles, metal cans, or poly bags, etc.). These smaller containers may have been single or double bagged prior to placement into the drum^{29,30}. At the present time drums with this packaging configuration will not be shipped. They require additional solid sampling characterization to confirm that they have the same hazardous waste numbers as the rest of the waste stream. In addition, TRUCONs ID111B and ID211B will need to be added to the waste stream and approved by CBFO prior to shipping.
- 1982 – 1986: Vermiculite used to fill space between the sealed polyethylene bag and liner
- 2002: Aquaset® (See Section 2.5) or vermiculite in varying amounts was added to drums of waste during the 3,100 m³ Project recovery operations. These drums can have package dates over the entire generation process time frame.
- 2002 on: AMWTP will add sufficient quantities of absorbent to absorb any remaining residual liquid. Addition of absorbent does not impact the WMC or HWN designation of the waste. Absorbent may be identified outside of expected time frames. Any absorbent expected in the waste stream is acceptable provided it does not exceed 50% by volume of the container. Absorbents outside of the expected time frames are atypical,

but do not impact waste matrix code assignment or hazardous waste number assignment^{24,28}.

2.1.3 Drum Packaging- RF IDC 001

Note: Lead sheeting is not expected to have been in place to keep the drums at CH radiation levels. However, lead sheeting may interfere with AMWTP's ability to characterize or certify waste using either RTR or assay. Drums with lead sheeting will not be shipped to WIPP unless characterization and certification can be adequately performed.

- 1971 – 1972: Two polyethylene drum bags²⁶
Bag closure method “twisted and taped”²⁶
- 1971 – 1972: Polyethylene drum bag and PVC O-ring bag
Lead sheeting may have been used to line inside of drum
Bag closure method “twisted and taped”
- 1972 – 1986: 90-mil rigid polyethylene liner or round bottom liner²⁷
Polyethylene drum bag and PVC O-ring bag, or a single round bottom polyethylene liner placed between the rigid liner and O-ring bag
Lead tape may have been used to wrap the outside of the rigid liner
Bag closure method “twisted and taped”
- 1971 – 1986: Drum stub bags may be identified in containers that were visually examined or cored at WMF-634²³

“Filtered bag” method used for bag closure in drums visually examined at Argonne-West as part of the 3,100 m³ Project¹⁷
- 2002 on: Drums having breached liners, container integrity issues, or as needed for optimization, will be overpacked into ten-drum overpack (TDOP) configurations. Drums processed through liquid absorption or intrusive characterization are expected to have 0 or 1 layer of containment. These drums can be shipped under ID111D or ID211D TRUCONs.

Varying combinations of drum bags, poly bags, and O-ring bags were identified during INEEL characterization activities, including drums with 0 layers of containment.²² Any combination of plastic bagging, provided that two layers of containment are not exceeded, does not impact acceptability of the drum. In addition, some drums packaged 1972 and later may not include a rigid liner.¹⁹ The configurations are atypical, but do not impact WMC assignment or HWN assignment.

2.2 Waste Packaging – RF IDC 002

2.2.1 Inner Packaging – RF IDC 002

IDC 002 is a monolithic sludge placed directly into drums bags. There is no inner packaging.

2.2.2 Absorbent – RF IDC 002

The following absorbents were used at the time of waste packaging.

- 1969 – 1970: 3 to 5 pounds of Portland cement (See Section 2.5) at bottom of drum²⁶
3 to 5 pounds of Portland cement (See Section 2.5) in the bottom of drum bag²⁶
3 to 5 pounds of Portland cement (See Section 2.5) on top of sludge in inner poly bag²⁶
~5 pounds of Portland cement (See Section 2.5) on top of outer poly bag²⁶
Portland cement (See Section 2.5) layered throughout the drums²⁶
- 1971 – 1985: 3 to 5 pounds of Portland cement (See Section 2.5) at bottom of drum (1970-72)
Portland cement (See Section 2.5) placed in bottom of rigid liner (1972-85)
3 to 5 pounds of Portland cement (See Section 2.5) in the bottom of drum bag
3 to 5 pounds of Portland cement (See Section 2.5) at the bottom of the plastic bag
~30 pound of Portland cement (See Section 2.5) layered throughout the drum
3 to 5 pounds of Portland cement (See Section 2.5) on top of the last layer of sludge
~5 pounds of Portland cement (See Section 2.5) on top of the plastic bag
- 1971 – 1982: 1 to 2 quarts of Oil-Dri® (See Section 2.5) on top of outer, sealed polyethylene bag
- 1982 – 1985: Vermiculite used to fill space between the sealed polyethylene bag and liner
- 2002: Aquaset® (See Section 2.5) or vermiculite in varying amounts was added to drums of waste during the 3,100 m³ Project recovery operations. These drums can have package dates over the entire generation process time frame. Absorbent may be identified outside of expected time frames. Any absorbent expected in the waste stream is acceptable provided it does not exceed 50% by volume of the container. Absorbents outside of the expected time frames are atypical, but do not impact waste matrix code assignment or hazardous waste number assignment^{24,28}.
- 2002 on: AMWTP will add sufficient quantities of absorbent to absorb any remaining residual liquid. Addition of absorbent does not impact the WMC or HWN designation of the waste or the package date.

2.2.3 Drum Packaging – RF IDC 002

Note: Lead sheeting is not expected to have been in place to keep the drums at CH radiation levels. However, lead sheeting may interfere with AMWTP's ability to characterize or certify waste using either RTR or assay. Drums with lead sheeting will not be shipped to WIPP unless characterization and certification can be adequately performed.

- 1971 – 1972: Two polyethylene drum bags²⁶

- Bag closure method "twisted and taped"²⁶
- 1971 – 1972: Polyethylene drum bag and PVC O-ring bag
Lead sheeting may have been used to line inside of drum
Bag closure method "twisted and taped"
- 1972 – 1985: 90-mil rigid polyethylene liners
Polyethylene drum bag and PVC O-ring bag, or single round bottom polyethylene liner within the rigid liner
Lead tape may have been used to wrap the outside of the rigid liner
Bag closure method "twisted and taped"
- 1971 – 1986: Drum stub bags may be identified in containers that were visually examined or cored at WMF-634²³
- "Filtered bag" method used for bag closure in drums visually examined at Argonne-West as part of the 3,100 m³ Project¹⁷
- 2002 on: Drums having breached liners, container integrity issues, or as needed for optimization, will be overpacked into TDOP configurations. Drums processed through liquid absorption or intrusive characterization are expected to have 0 or 1 layer of containment. These drums can be shipped under ID111D or ID211D TRUCONs.

Varying combinations of drum bags, poly bags, and O-ring bags were identified during INEEL characterization activities, including drums with 0 layers of containment. Any combination of plastic bagging, provided that two layers of containment are not exceeded, does not impact acceptability of the drum. The configurations are atypical, but do not impact WMC assignment or HWN assignment.

2.3 Waste Packaging - RF IDC 800

2.3.1 Inner Packaging- RF IDC 800

IDC 800 is a monolithic sludge placed directly into drums bags. There is no inner packaging.

2.3.2 Absorbent- RF IDC 800

The following absorbents were used at the time of waste packaging.

- 1985 – 1989: Vermiculite used to fill space between the sealed polyethylene bag and liner
- 2002: Aquaset® (See Section 2.5) or vermiculite in varying amounts was added to drums of waste during the 3,100 m³ Project recovery operations. These drums can have package dates over the entire generation process time frame.
- 2002 on: AMWTP will add sufficient quantities of absorbent to absorb any remaining residual liquid. Addition of absorbent does not impact the WMC or HWN designation of the waste or the package date. Absorbent may be identified outside of expected time frames. Any

absorbent expected in the waste stream is acceptable provided it does not exceed 50% by volume of the container. Absorbents outside of the expected time frames are atypical, but do not impact waste matrix code assignment or hazardous waste number assignment^{24,28}.

2.3.3 Drum Packaging- RF IDC 800

- 1985 – 1989: 90-mil rigid polyethylene liners
Polyethylene drum bag and PVC O-ring bag
Lead tape may have been used to wrap the outside of the rigid liner
Bag closure method “twisted and taped”
- 1985 – 1989: Drum stub bags may be identified in containers that were visually examined or cored at WMF-634²³.

“Filtered bag” method used for bag closure in drums visually examined at Argonne-West as part of the 3,100 m³ Project¹⁷
- 2002 on: Drums having breached liners, container integrity issues, or as needed for optimization, will be overpacked into TDOP configurations. Drums processed through liquid absorption or intrusive characterization are expected to have 0 or 1 layer of containment. These drums can be shipped under ID111D or ID211D TRUCONs.

Varying combinations of drum bags, poly bags, and O-ring bags were identified during INEEL characterization activities, including drums with 0 layers of containment. Any combination of plastic bagging, provided that two layers of containment are not exceeded, does not impact acceptability of the drum. The configurations are atypical, but do not impact WMC assignment or HWN assignment.

2.4 Flammability Consideration

Cyclohexane, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene are required analytes for determining the total flammable volatile organic compounds for transportation. These three compounds are not target analytes for the Waste Analysis Plan and are not included on the target list for AMWTPs current system. For First/Second Stage Sludge, acceptable knowledge information for these analytes will be used for the flammability evaluation. The following values are the AK recommended concentrations and are the maximum reported concentrations out of over 2,620 samples:

1,2,4-Trimethylbenzene	6.50 ppmv
1,3,5-Trimethylbenzene	6.00 ppmv
Cyclohexane	18 ppmv

2.5 Tradename Index

Tradename	Chemical Constituents
Aquaset	Sodium montmorillonite ³²
Oil-Dri	Crystalline silica and clay minerals, e.g. montmorillonite, bentonite ³³
Ox Out 536	Water, ammonium bifluoride, and nitric acid ³⁵
Portland Cement	Tricalcium silicate, dicalcium silicate, tricalcium aluminate, calcium alumino ferrite, gypsum, calcium oxide, magnesium oxide, sodium sulfate, potassium sulfate, crystalline quartz silica, trace chromium ³⁴
PuriFloc A23 Flocculant	Hydrolyzed polyacrylamide, sodium carbonate, sodium sulfite, sodium sulfate, proprietary ingredients, water ³⁶

3. PROCESS FLOW DIAGRAMS

This section contains process flow diagrams available for the First/Second Stage Sludge waste stream.

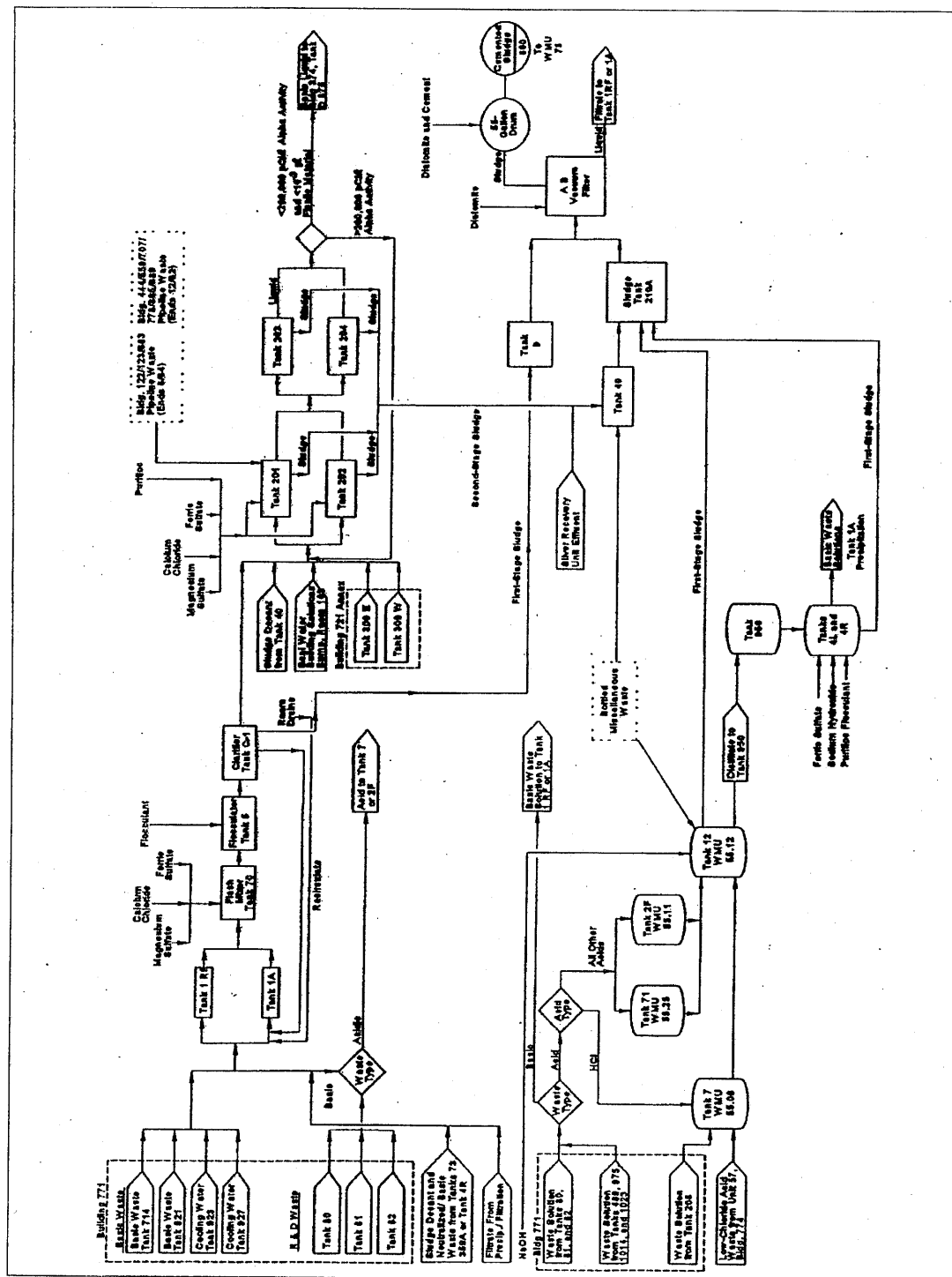


Figure 3-1. Building 774 Aqueous Waste Treatment Process.